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| EXAMINER | |
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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 10/589,620
Filing Date: August 01, 2007
Appellant(s): KAWAGUCHI ET AL.

Darrin A. Auito
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed March 29, 2011 appealing from the Office action mailed August 13, 2010.

**(1) Real Party in Interest**

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The following is a list of claims that are rejected and pending in the application:

Claims 1 and 2 are pending.

**(4) Status of Amendments After Final**

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

**(5) Summary of Claimed Subject Matter**

The examiner has no comment on the summary of claimed subject matter contained in the brief.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

**(7) Claims Appendix**

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 6,086,261 | Nakagawa et al. | 6-2000 |

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. (USP 6,086,261).

Re claim 1, Nakagawa (Fig. 9) discloses an outer ring 1 having an outer ring raceway surface undergoing crowning, an inner ring 2 having an inner ring raceway surface undergoing crowning, and plural tapered rollers 3 having a rolling surface undergoing crowning, which are located as rolling universally between said outer 1 and inner 2 ring raceway surfaces.

Nakagawa does not expressly disclose the total crowning amount, defined as the sum of crowning amount of outer ring 1, the crowning amount of inner ring 2 and two times the crowning amount of the roller 3, is more than 50 μm, and the crowning ratio of the outer ring 1, defined as crowning amount of outer ring 1 divided by the total

crowning amount, is 40% or more, and the roller 3 crowning ratio, defined as two times the roller 3 crowning amount divided by the total crowning amount, is 20% or less.

Nakagawa does disclose (col. 13, lines 9 – 13) that a crowning amount *"can be optionally set within the range of 1-6 µm for the rolling surface 3c', 1-20 µm for the raceway surface 1a', and 1-20 µm for the raceway surface 2a' (10-50 µm for compound crowning)."* Nakagawa further discloses that the crowning amount has an impact on roller settling, or running-in time prior to bearing preload, such that optimizing the crowning amount can improve running-in time, thereby reducing the time to bearing preload (col. 13, lines 13 – 17). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Nakagawa, such that the total crowning amount, defined as the sum of crowning amount of outer ring 1, the crowning amount of inner ring 2 and two times the crowning amount of the roller 3 times, is more than 50 µm, and the crowning ratio of the outer ring 1, defined as crowning amount of outer ring 1 divided by the total crowning amount, is 40% or more, and the roller crowning ratio, defined as two times the roller 3 crowning amount divided by the total crowning amount, is 20% or less, since it has been held that discovering optimum value of a result effective variable involves only routine skill in the art.

Re claim 2, Nakagawa (col. 13, lines 9 – 13) discloses the inner wheel crowning ratio, defined as crowning amount of the inner ring 2 (max. 20 µm) divided by the total crowning amount (*considering the max. of 52 µm = 2x6 µm for 3c' + 20 µm for 1a' + 20 µm for 2a'*), is 10% or more (20/52 = 0.38 or 38%, which is greater than 10%).

**(10) Response to Argument**

On **Issue 1**, the Appellants submit, *"Nakagawa et al. does not disclose a technical idea, let alone define particular ranges of the total crowning amount and the crowning amount ratios of the outer ring, tapered roller and inner ring to the total crowning amount so as to achieve the presently claimed advantageous effects and unexpected results. Thus, it cannot be predicted by Nakagawa that the effect of rotation torque reduction is obtained in the specific ranges of the total crowning amount and the crowning amounts of inner and outer rings and tapered roller as indicated in Figs. 6-8 of the present application. Nakagawa discloses that the tapered rollers are axially moved to be pressed against the cone back face rib face of the inner ring for allowing the tapered rollers to settle in their normal positions (col. 11, lines 54-58). When the tapered roller contacts the cone back face rib face in this manner, the rolling friction between the tapered roller and the internal ring increases as a matter of course, resulting in the increase of the rotation torque of the tapered roller bearing. This leads to a completely opposite effect to that of the present invention intending to decrease the rotation torque of a tapered roller bearing."*

The Examiner respectfully disagrees. First, the Appellants "technical idea" is beyond the scope of the invention as claimed. That fact that the Appellant has a different reason for obtaining the claimed ranges does not indicate that Nakagawa cannot predict or obtain the same claimed ranges for an entirely different reason. Nakagawa teaches (col. 13, lines 9 – 13) that a crowning amount *"can be optionally set within the range of 1-6 μm for the rolling surface 3c', 1-20 μm for the raceway surface*

*1a', and 1-20 µm for the raceway surface 2a' (10-50 µm for compound crowning)..."* for the purpose of ensuring *"smooth axial movement of the tapered roller 3 toward the cone back face rib face 2c during the running-in operation and shortens the running-in operation time."* It is clear that Nakagawa recognizes the crowning amount as a result effective variable. Furthermore, Nakagawa does not teach away or disclose any negative results with crowning amounts for the raceway 1a' and 2a' and roller 3c' surfaces exceeding the disclosed ranges. Thus, optimizing the total crowning amount or the crowning ratios of the raceway and roller surfaces to the claimed ranges is only a matter of routine skill in the art.

On **Issue 2**, the Appellants further submit, *"that Figs. 6-9 show, for example, the criticality of the claimed range. The inventors conducted verification test(s) (results in Figs. 6-9) to clarify the relationship between the rotational torque of the tapered roller bearing, the total crowning amount, and each crowning ratio. Many different tapered roller bearings were prepared, in which the total crowning amount and each crowning ratio were set to various values, to experimentally measure the resultant rotation torque. The test confirmed that the rotation torque of the tapered roller bearing decreases provided that the total crowning amount is 50 µm or more, the outer ring crowning ratio is 40% or more, and the roller crowning ratio is 20% or less. Whereas, Nakagawa's roller crowning ratio is greater than 20%. As shown in the scatter graph illustrated in Fig. 8, when the roller crowning ratio is 20% or less (claimed range), the torque ratio stably scatters in a lower-value range in comparison with the case where the roller crowning ratio is more than 20% (Nakagawa's ratio is 23.1%). See paragraph [0031]. Also,*

*Nakagawa's outer ring crowning ratio is less than 40%. As shown in the scatter graph illustrated in Fig. 9, when the outer ring crowning ratio is 40% or more, the torque ratio stably scatters in a lower-value range compared with the case in which the outer ring crowning ratio is less than 40% (Nakagawa's ratio is 38.5%). See paragraph [0030]. Nakagawa does not recognize that satisfying the claimed ranges reduces the rotational torque of the tapered roller bearing. Instead, Nakagawa only mentions that arrangement described in the specification and recited partly above (e.g., col. 13, lines 9-13)"ensures smooth axial movement of the tapered roller 3 toward the cone back face rib face 2c during the running- in operation and shortens the running-in operation time." See Col. 13, lines 13-17. Thus, the particular claimed ranges are critical and achieve unexpected results relative to the Nakagawa et al. range As such, Applicants submit that a prima facie case of obviousness has not been presented."*

The Examiner respectfully disagrees. As stated above, that fact that the Appellant has a different reason for obtaining the claimed ranges does not indicate that Nakagawa cannot predict or obtain the same claimed ranges for an entirely different reason.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/PHILLIP A JOHNSON/

Examiner, Art Unit 3656

Conferees:

/MJ/ Marc Jimenez

/Thomas R. Hannon/

Primary Examiner, Art Unit 3656